Long-range Transported Air Pollution from Wild-fires and Cardiorespiratory Hospitalisations

Timo Lanki, *National Institute for Health and Welfare (THL), Kuopio, Finland*
Jarkko V. Niemi, *Helsinki Region Environmental Services Authority (HSY), Finland*
Pekka Tiittanen, *National Institute for Health and Welfare (THL), Kuopio, Finland*
Tarja Yli-Tuomi, *National Institute for Health and Welfare (THL), Kuopio, Finland*
Raimo O. Salonen, *National Institute for Health and Welfare (THL), Kuopio, Finland*

Background and aims: Large amounts of particulate air pollution (PM) are emitted yearly from wild-fires around the globe. Previous studies suggest that acute exposure to PM from wild-fires is associated with respiratory symptoms and even hospitalizations. However, litte is known about possible cardiovascular effects of long-range transported wild-fire smoke. Our aim was to evaluate the association of fine particles (PM2.5; diameter <2.5 µm) measured during episodes of long-range transported wild-fire smoke with cardiovascular and respiratory hospitalizations.
Methods: Data on total cardiovascular and respiratory hospitalisations was obtained for the Helsinki Metropolitan Area (around 1 million inhabitants) from the national hospital discharge register. Outdoor PM2.5 was measured at an urban background and a rural measurement station. Days when PM2.5 levels were simultaneously elevated (>25 µg/m3) at both stations were categorized as episode days of long-range transportation. Episodes were further divided between episodes from wild-fires and other sources based on backward air mass trajectories, remote sensing of fire hot spots, and dispersion modeling of smoke. Case-crossover study design and logistic regression models were used to analyse the data. Models were adjusted for temperature, relative humidity, coarse particles, influenza, and pollen. Control days were selected for each individual as the same weekdays within the same month as the event day.
Results: There were 14 episode days linked with long-range transported wild-fire smoke in 2001–2005. The smoke typically originated from large fires in Eastern Europe. Daily mean PM2.5 concentrations were 7.9 and 26 µg/m3 during non-episode and episode days, respectively. Risk of cardiovascular hospitalization was increased 33 % (95 % confidence intervals 0.1%-77%) per 10 µg/m3 increase in PM2.5 during wild-fire episode (1-day lag). PM2.5 from wild-fires was also associated with 39% (-2%-96%) increase in same-day respiratory hospitalisations.
Conclusions: During and right after episodes of long-range transported air pollution from open biomass-burning both respiratory and cardiovascular hospitalizations seem to be increased. Therefore, adverse health effects of wild-fires on populations are not limited to the immediate vicinity of fire areas.